REMARKS

Claims 1, 3-8 and 10-11 are pending in the present application. By this Response, claims 2, 4, 8, 9 and 12 are canceled and claims 1, 3, 5, 7 and 11 are amended. Claim 3 is amended to be in independent form. Claim 7 is amended to include the subject matter of originally presented claim 9. Claim 5 is amended in view of the cancellation of claim 4 and to be consistent with the amendment to claim 3. Claims 1 and 11 are amended to recite that the inverting of the depth coordinate is performed in a first stage of a hardware pipeline and the multiplying of the inverted depth coordinate with the position and texture coordinates is performed in a second stage of the hardware pipeline. Reconsideration of the claims in view of the above amendments and the following remarks is respectfully requested.

I. 35 U.S.C. § 103, Obviousness, Claims 1-6, 11 and 12

The Office Action rejects claims 1-6, 11 and 12 under 35 U.S.C. § 103(a) as being unpatentable over Strunk et al. (U.S. Patent No. 6,137,497) in view of Taylor et al. (U.S. Patent No. 6,518,974 B2), and further in view of Narayanswami (U.S. Patent No. 5,973,705). This rejection is moot with regard to canceled claims 2, 4 and 12 and is respectfully traversed with regard to the remaining claims.

As to claims 1-6, 11 and 12, the Office Action states:

> a. Regarding claim 1, Strunk et al. **discloses** a method in a graphics adapter for displaying an object, the method comprising: receiving position coordinates ("eye" coordinates 110 (eye space)) and texture coordinates ("object" coordinates 108 (object space)) for the object; and displaying the object using the adjusted position coordinates and the adjusted texture coordinates (...processes primitive data received from the host processor...the graphics primitives are typically specified by X,Y, Z, and W object coordinate data and R, G...S, T, R...texture data for portions of the graphics primitives...col. 8, lines 60-67; col. 9, lines 1-3...homogeneous window coordinates...col. 5, lines 38-40;). Strunk et al. **is silent about** inverting a depth coordinate associated with the position and the texture coordinates to form an inverted coordinate; multiplying the position coordinates and the texture coordinates by the inverted coordinate to form adjusted position coordinates and adjusted texture coordinates. Taylor et al. **discloses** inversion of a depth coordinate and multiplying this

now inverted depth coordinate associated with the texture coordinates to form adjusted texture coordinates (...this function computes...for each of the polygon's input values...and1/w...texture perspective correction multiplies...by1/w...col. 4, lines 39-53). However, Taylor et al. **does not disclose** multiplying inverted depth coordinate being with the position coordinates. Narayanaswami **discloses** where 1/x operation is used for perspective projection of a vertex (col. 1, lines 27-43). However, perspective correction involves 1/w operation. Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to modify Strunk et al. with the feature "texture perspective correction using 1/w" as taught by Taylor and modify Strunk-Taylor combination with the feature "1/w for perspective correction" as taught implicitly by Narayanswami **because** it provides a means for improved graphics data processing and related computations.

Claim 1, which is representative of the other rejected independent claims 3 and 11 with regard to similarly recited subject matter, reads as follows:

1. A method in a graphics adapter for displaying an object, the method comprising:
receiving position coordinates and texture coordinates for the object;
inverting in a first stage of a hardware pipeline a depth coordinate associated with the position and the texture coordinates to form an inverted coordinate;
multiplying in a second stage of the hardware pipeline the position coordinates and the texture coordinates by the inverted coordinate to form adjusted position coordinates and adjusted texture coordinates; and
displaying the object using the adjusted position coordinates and the adjusted texture coordinates. (emphasis added)

Neither Strunk, Taylor nor Narayanaswami teach or suggest inverting a depth coordinate in a first stage of a hardware pipeline or multiplying position and texture coordinates by the inverted coordinate in a second stage of a hardware pipeline.

Strunk is directed to system and method for performing view clipping and model clipping of graphics primitives in a geometry accelerator of a computer graphics system. The purpose of Strunk is to reduce the number of clipping processors needed in a geometry accelerator such that clipping may be performed in hardware rather than in software. While Strunk teaches graphics primitives are typically specified by X, Y, Z and W object coordinate data; R, G, B, and α color data; and S, T, R, and Q texture data

for vertices (see column 8, line 60 to column 9, line 3), Strunk does not teach or suggest inverting a depth coordinate associated with position and texture coordinates or multiplying the position and texture coordinates by an inverted coordinate. The Office Action admits that Strunk does not teach this feature (see Office Action, page 3). Furthermore, Strunk does not teach or suggest inverting a depth coordinate in a first stage of a hardware pipeline and multiplying the inverted depth coordinate with the position and texture coordinates in a second stage of a hardware pipeline.

The Office Action alleges that Strunk teaches a first stage and a second stage of a pipeline as modelview matrix 100, projection matrix P 102 and perspective division 104. While these may be stages of a pipeline, there is no teaching or suggestion in Strunk that the modelview matrix 100, projection matrix 102 or perspective division 104 in Figure 1 of Strunk inverts a depth coordinate or that any of these alleged stages multiplies an inverted depth coordinate with position and texture coordinates. In fact, the Office Action admits that Strunk does not teach these features.

The Office Action alleges that Taylor teaches inverting a depth coordinate and multiplying it with texture coordinates to form adjusted texture coordinates. Taylor is directed to a pixel engine in which the rate of change of texture addresses when mapped to individual pixels of a polygon is used to obtain the correct level of detail map from a set of prefiltered maps. With Taylor, a first determination of perspectively correct texture address values is found at four corners of a predefined span or grid of pixels. Then, a linear interpolation technique is implemented between the perspectively bound span corners. This linear interpolation technique is performed in both screen directions to thereby create a level of detail value for each pixel.

Taylor does teach the inverting of the depth coordinate W and the multiplication of the inverted depth coordinate with the texture coordinates (column 4, lines 39-52). However, this inversion and multiplication is performed outside the pipeline in a separate device called the plane converter (see Figure 4 of Taylor). As shown in Figure 4, and described in column 4, lines 39-52, of Taylor, the plane converter (PC) performs the inversion and multiplication of the depth coordinate W and provides the result to the mapping engine (ME) which contains the texture pipeline (TP). Thus, Taylor does not teach or suggest the inverting of a depth coordinate being performed in a first stage of a

B

hardware pipeline and the multiplication of the inverted depth coordinate with texture coordinates and position coordinates in a second stage of the hardware pipeline. To the contrary, Taylor actually teaches away from such features in that a separate device outside the pipeline is used to perform the inversion and multiplication of a depth coordinate.

Thus, neither Strunk nor Taylor, either alone or in combination, teach or suggest the features of inverting, in a first stage of a hardware pipeline, a depth coordinate associated with the texture coordinates to form an inverted coordinate or multiplying, in a second stage of the hardware pipeline, the position coordinates and the texture coordinates by the inverted coordinate to form adjusted texture coordinates. Furthermore, Narayanaswami does not teach or suggest these features either.

Narayanaswami is directed to a geometry pipeline implemented on a single instruction multiple data (SIMD) machine. Narayanaswami is directed to a machine for calculating 1/x or 1/sqrt(x) functions without requiring a ROM-based lookup table. With the system of Narayanaswami, instructions in a pipeline are monitored for a 1/x or 1/sqrt(x) seed instruction. Upon detection of such a seed instruction, portions of the instruction are forwarded to combinatorial logic that implements the given instruction. The portions of the instruction that are forwarded include the data value of x and the target address or register to which to write the result.

While Narayanaswami teaches that perspective projection of a vertex, texture mapping calculations, and color and other parameter slope calculations typically include a reciprocal 1/x operation (column 1, lines 37-43), there is no teaching or suggestion in Narayanaswami to invert a depth coordinate in a first stage of a hardware pipeline and then multiply the inverted depth coordinate with the position and texture coordinates in a second stage of the hardware pipeline, as recited in claim 1. To the contrary, Narayanaswami teaches that if a 1/x or 1/sqrt(x) operation is detected in the pipeline, the function is sent out of the pipeline to combinatorial logic. Thus, as with Taylor, the inverting of a value is performed outside the pipeline and not within a first stage of a hardware pipeline. Furthermore, as with Taylor, the multiplying of the inverted value with coordinates is not performed within a second stage of the hardware pipeline.

B

In view of the above, Applicants respectfully submit that neither Strunk, Taylor, nor Narayanaswami, either alone or in combination teach or suggest the features of independent claim 1 or the similar features round in independent claim 11. Claim 3 recites similar features to that of claim 1 and 11 by reciting "a first stage, wherein the first stage receives the position coordinates and the depth coordinate and inverts the depth coordinate" and "a second stage, wherein the second stage multiplies the position coordinates by the inverted depth coordinate." These features are not taught or suggested by the alleged combination of Strunk, Taylor and Narayanaswami for similar reasons as noted above.

Thus, the alleged combination of references does not obviate all of the features recited in independent claims 1, 3 and 11. At least by virtue of their dependency on claim 3, neither Strunk, Taylor, nor Narayanswami, either alone or in combination, teach or suggest the features of dependent claims 5-6. Accordingly, Applicants respectfully request withdrawal of the rejection of claims 1, 3, 5-6 and 11 under 35 U.S.C. § 103(a).

In addition to the above, the alleged combination of Strunk, Taylor and Narayanswami does not teach or suggest all of the specific features of dependent claims 5-6. Regarding the features of claim 5, the features of claim 5 have been addressed above with regard to the rejection of claims 1, 3 and 11. That is, none of the cited references, either alone or in combination, teach or suggest the first stage or the second stage recited in claim 5.

Regarding claim 6, neither Strunk, Taylor nor Narayanswami, either alone or in combination, teach or suggest processing of the position coordinates and the texture coordinates for an object occurs within five clock cycles. Rather than actually finding this feature in any secondary reference, however, the Examiner merely alleges that this feature would have been obvious to a person skilled in the art at the time of the invention was made to take advantage of multiplying a reciprocal term instead of a division operation because a multiply operation is repeated addition which is less computationally intensive as compared to a division operation. Applicants respectfully disagree and request that the Examiner cite a reference in support of the allegation that this feature would have been obvious. While it may be beneficial to use multiplication over division because it is less computationally intensive, there is no teaching or suggestion in any of

B

the cited references, or the general knowledge of the "digital processing art" to perform such multiplication of a inverted depth coordinate with position and texture coordinates within 5 clock cycles.

Furthermore, since the Examiner fails to cite any reference that teaches or suggests the specific features of claim 6, and merely makes the allegation without any supported evidence, the Examiner has failed to establish a *prima facie* case of obviousness with regard to claim 6. Thus, unless the Examiner is able to cite a reference in support of the allegation that it would have been obvious to a person of ordinary skill in the art at the time of the invention to process of the position coordinates and the texture coordinates for an object within five clock cycles, then the Applicants' are entitled to a grant of patent on claim 6.

The initial burden of establishing a *prima facie* basis to deny patentability to a claimed invention is always upon the Patent Office. *In re Oetiker*, 977 F.2d 1443, 1445, 24 U.S.P.Q.2d 1443, 1444 (Fed. Cir. 1992); *In re Piasecki*, 745 F.2d 1468, 1472, 223 U.S.P.Q. 785, 788 (Fed. Cir. 1984). A prima facie case of obviousness is established when the teachings of the prior art itself suggest the claimed subject matter to a person of ordinary skill in the art. *In re Bell*, 991 F.2d 781, 783, 26 U.S.P.Q.2d 1529, 1531 (Fed. Cir. 1993). Only when a *prima facie* case of obviousness is established does the burden shift to the applicant to produce evidence of nonobviousness. *In re Oetiker*, 977 F.2d 1443, 1445, 24 U.S.P.Q.2d 1443, 1444 (Fed. Cir. 1992); *In re Rijckaert*, 9 F.3d 1531, 1532, 28 U.S.P.Q.2d 1955, 1956 (Fed. Cir. 1993). If the Patent Office does not produce a *prima facie* case of unpatentability, then without more the applicant is entitled to grant of a patent. *In re Oetiker*, 977 F.2d 1443, 1445, 24 U.S.P.Q.2d 1443, 1444 (Fed. Cir. 1992); *In re Grabiak*, 769 F.2d 729, 733, 226 U.S.P.Q. 870, 873 (Fed. Cir. 1985).

In view of the above, Applicants respectfully submit that neither Strunk, Taylor nor Narayanswami, teach or suggest all of the specific features recited in dependent claims 5 and 6. Accordingly, Applicants respectfully request withdrawal of the rejection of claims 5 and 6 under 35 U.S.C. § 103(a).

B

II. 35 U.S.C. § 103, Obviousness, Claims 7-10

The Office Action has rejected claims 7-10 under 35 U.S.C. § 103(a) as being unpatentable over Strunk et al. in view of Taylor et al., and further in view of Murphy (U.S. Patent No. 5,805,868). This rejection is moot with regard to canceled claims 8 and 9 and is respectfully traversed with regard to claims 7 and 10.

The Strunk and Taylor references have been address above. Murphy does not provide for the deficiencies of Strunk and Taylor. That is, Murphy does not teach or suggest a first stage of a hardware pipeline inverting a depth coordinate and a second stage of the hardware pipeline multiplying position and texture coordinates by the inverted depth coordinate. The Murphy reference is cited as teaching a raster engine. While Murphy may teach a raster engine that rasterizes processed graphics data for display and a geometry engine connected to the raster engine, the geometry engine of Murphy does not include a hardware pipeline that has a first stage that generates an inverted depth coordinate and a second stage that multiplies position and texture coordinates by the inverted depth coordinate, as recited in claim 7.

As noted above, the Office Action alleges that Strunk teaches a first stage and a second stage of a pipeline in Figure 1 as elements 100, 102 and 104. As discussed above with regard to claim 1, there is no teaching or suggestion in Strunk, or any of the other cited references, that a first stage, e.g., element 100, 102 or 104, inverts a depth coordinate and a second stage, e.g., element 102 or 104, multiplies the depth coordinate with position or texture coordinates. To the contrary, the only teachings in any of the references regarding the inverting of a depth coordinate and multiplying of the depth coordinate with position or texture coordinates is to do so outside the hardware pipeline. There is no teaching or suggestion in any of the cited references to have a first stage of a hardware pipeline invert the depth coordinate and a second stage of the hardware pipeline multiply the inverted depth coordinate with texture and position coordinates.

In view of the above, Applicants respectfully submit that neither Strunk, Taylor, nor Murphy, either alone or in combination, teach or suggest all of the features of independent claim 7. At least by virtue of its dependency on claim 7, Strunk, Taylor and Murphy do not teach or suggest the features of dependent claim 10. In addition, as

mentioned above with regard to claim 6, neither Strunk nor Taylor teach or suggest performing the processing of position and texture coordinates within 5 clock cycles. Murphy, likewise, does not teach or suggest this feature. Accordingly, Applicants respectfully request withdrawal of the rejection of claims 7, 8 and 10 under 35 U.S.C. § 103(a).

III. Conclusion

It is respectfully urged that the subject application is patentable over Strunk, Taylor, Narayanswami and Murphy and is now in condition for allowance. The Examiner is invited to call the undersigned at the below-listed telephone number if in the opinion of the Examiner such a telephone conference would expedite or aid the prosecution and examination of this application.

Respectfully submitted,

DATE: August 18, 2003

Stephen J. Walder

Stephen J. Walder, Jr.
Reg. No. 41,534
Carstens, Yee & Cahoon, LLP
P.O. Box 802334
Dallas, TX 75380
(972) 367-2001
Attorney for Applicant

B